

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. *(Currently Amended)* A method for making a remote copy between a first storage subsystem and a second storage subsystem which are connected to each other via a path, the first storage system connected to a first host, the method comprising the steps of:

providing a first logical volume to the first storage subsystem and a second logical volume to the second storage subsystem[[,]];

copying the contents of the first logical volume to the second logical volume being a copied logical volume of the first logical volume, the first logical volume and the second logical volume being in sync state;

making a third logical volume in the first storage subsystem and copying first data from the first logical volume to the third logical volume, the first logical volume and the third logical volume being in sync state;

making a fourth logical volume in the second storage subsystem and copying second data from the second logical volume to the fourth logical volume, the second logical volume and the fourth logical volume being in sync state, wherein the copying of the second data is performed after the copying the contents of the first logical volume to the second logical volume;

after the copying of the first data from the first logical volume to the third logical volume, breaking the sync state between the first logical volume and the third logical volume; [[and]]

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

after copying of the second data from the second logical volume to the fourth logical volume breaking the sync state between the second logical volume and the fourth logical volume based on a command;

after the copying of the first data from the first logical volume to the third logical volume and after copying of the second data from the second logical volume to the fourth logical volume, establishing a synchronization link between the fourth logical volume and the third logical volume;

coupling a first auxiliary host to the third logical volume; and

enabling the first auxiliary host to perform operations on the third logical volume while the first host continues operations on the first logical volume and while the first logical volume and second logical volume continue in sync state.

2. *(Previously Presented)* The method of claim 1, further comprising:

providing a second auxiliary host at the second storage subsystem, the second auxiliary host having permissions to access the fourth logical volume; and

executing applications using the first auxiliary host, the second auxiliary host, the third logical volume and the fourth logical volume.

3. *(Previously Presented)* The method of claim 2, wherein

executing applications comprises performing data recovery testing

storing a test copy of data used by the first host on the third logical volume, and

forming a mirror image of data in the third logical volume on the fourth volume.

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

4. *(Previously Presented)* The method of claim 3, wherein
data recovery testing comprises:
simulating a disaster at the first auxiliary host; and
testing backup of information from the third logical volume to the fourth logical volume,
and recovery therefrom.

5. *(Previously Presented)* The method of claim 2, wherein
executing applications comprises performing data mining,
establishing on the third volume a data warehouse having a copy of on line transactions
processing (OLTP) data used by the first host, and
forming a mirror image of data in the third logical volume on the fourth volume.

6. *(Previously Presented)* The method of claim 5, wherein
data mining comprises:
establishing a data warehouse having a copy of on line transaction processing data at the
first auxiliary host;
performing data analyses on the data warehouse information, and
performing backups and/or recovery of the data warehouse information of the third
logical volume to the fourth logical volume.

7. *(Original)* The method of claim 1, further comprising:
determining if the sync state between the first logical volume and the second logical
volume is an asynchronous mirror, and if so:

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

inhibiting sending of further write data from the first storage subsystem to the second storage subsystem;

recording incoming write data at the first storage subsystem; and

re-synchronizing the first logical volume and the second logical volume after breaking the sync state between the second logical volume and the fourth logical volume.

8. *(Original)* The method of claim 1, wherein

synchronizing the fourth logical volume with the third logical volume comprises:

issuing a command to form a mirror with a no copy option; and

creating a new copy management storage area for the mirror.

9-10. *(Cancelled)*

11. *(Currently Amended)* An apparatus, comprising:

a first means for storing data;

a first host coupled to the first means for storing data;

a second means for storing data, being remotable from and a copy of content of the first means for storing data, and being in a sync state with the first means for storing data;

a third means for storing data, co-located with and a copy of content of the first means for storing data, and being in a sync state with the first means for storing data;

a fourth means for storing data, co-located with and a copy of content of the second means for storing data, and being in a sync state with the second means for storing data, wherein the sync state between the second means for storing data and the fourth means for storing data is

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

established after establishing of the sync state between the first means for storing data and the second means for storing data;

a means for breaking the sync state between the first means for storing data and the third means for storing data after establishing the sync state between the first means for storing data and the third means for storing data and for breaking the sync state [[and]] between the second means for storing data and the fourth means for storing data after establishing the sync state between the first means for storing data and the third means for storing data;

a means for synchronizing the fourth means for storing data with the third means for storing data after copying of content of the first means for storing data and the second means for storing data and breaking the sync state; and

means for coupling a first auxiliary host to the third means for storing data; and
means for enabling the first auxiliary host to perform operations on the third means for storing data while the first host continues operations on the first means for storing data and while the first means for storing data and second means for storing data continue in sync state.

12. (*Original*) The apparatus of claim 11,

further comprising:

a means for creating an atomic split command, the command comprising:
an identity of a first means for storing data to serve as a primary volume; and
an identity of a second means for storing data to serve as a secondary volume.

13. (*Original*) The apparatus of claim 11,

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

further comprising:

a means for creating an atomic split command, the command comprising:

a first remote mirror, ORA_R1, comprised of the first means for storing data and the second means for storing data;

a second remote mirror, ORA_R2, comprised of the third means for storing data and the fourth means for storing data;

a first local mirror, ORA_L, comprised of the first means for storing data and the third means for storing data; and

a second local mirror, ORA_RL, comprised of the second means for storing data and the fourth means for storing data.

14. *(Currently Amended)* A method, comprising:

establishing a first remote mirror between a first logical unit in a first storage system and a second logical unit in a second storage system, the second storage system being remotable from the first storage system;

enabling a first host to perform operations on the first logical unit;

establishing a first local mirror between the first logical unit and a third logical unit in the first storage system;

establishing a second local mirror between the second logical unit and a fourth logical unit in the second storage system, wherein the second local mirror is established after establishing of the first remote mirror;

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

after establishing the first local mirror and the second local mirror, splitting the first local mirror and the second local mirror in response to a split command;
after establishing the first local mirror and the second local mirror, establishing a second remote mirror between the third logical unit and the fourth logical unit; and
coupling a first auxiliary host to the third logical unit; and
enabling the first auxiliary host to perform operations on the third logical unit while the first host continues operations on the first logical unit and while the first remote mirror remains established.

15. *(Original)* The method of claim 14, wherein
using the logical volumes of the first remote mirror for production processing; and
using the logical volumes of the second remote mirror for testing.

16. *(Original)* The method of claim 14, wherein
using the logical volumes of the first remote mirror for on line transaction processing;
and
using the logical volumes of the second remote mirror for data mining.

17. *(Original)* The method of claim 14, wherein
establishing a second remote mirror between the third logical unit and the fourth logical unit comprises:
issuing a create mirror command with a no copy option; and

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

creating a new copy management information store for managing mirroring between the third logical unit and the fourth logical unit.

18. (*Original*) The method of claim 14, wherein

splitting further comprises:

determining whether the first remote mirror is asynchronous, and if so:

copying all pending information to the second storage system.

19. (*Original*) A plurality of remote copy mirrors formed according to the method of claim 1.

20. (*Original*) A plurality of remote copy mirrors formed according to the method of claim 14.

21. (*Currently Amended*) A computer program product, comprising:

code for establishing a first remote mirror between a first logical unit in a first storage system and a second logical unit in a second storage system, the second storage system being remotable from the first storage system;

code for enabling a first host to perform operations on the first logical unit;

code for establishing a first local mirror between the first logical unit and a third logical unit in the first storage system;

Atty. Docket No.: CA1468
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 10/033,646

code for establishing a second local mirror between the second logical unit and a fourth logical unit in the second storage system, wherein the second local mirror is established after establishing of the first remote mirror;

code for splitting the first local mirror and the second local mirror in response to a split command, after establishing the first local mirror and the second local mirror;

code for establishing a second remote mirror between the third logical unit and the fourth logical unit, after establishing the first local mirror and the second local mirror;

code for coupling a first auxiliary host to the third logical unit;

code for enabling the first auxiliary host to perform operations on the third logical unit while the first host continues operations on the first logical unit and while the first remote mirror remains established; and

a computer readable storage medium for holding the codes.